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June 10, 1966

Office of Grants and Research Contracts
National Aeronautics and Space Administration
Washington D.C., 20546

Attention: Code SC/NGR 11-002-028-LDM:str

Subject: Research Grant No. NGR-11-002-028
Semiannual Status Report for the
Period December 16, 1965 to June 15, 1966
(Georgia Tech Project No. B-906)

Gentlemen:

The following represents a summary of the project status during the subject report period.

1. The Status

An official request for the extension of time without additional funds for the subject grant was made by Mr. Harry L. Baker of Georgia Tech on April 20, 1966. No official word has been heard from your office.

2. Progress During the Reporting Period

A. Liquid Oscillations in a rotating Container: The results of the analysis have been rechecked and some of the Eigenfrequencies were approximately determined numerically. It was found that the roots of such a system are for no rotation of the container, i.e., $\Omega_o = 0$, equal to those of the annular circular container. These were presented in NASA-TN-557 (1960).

Because of excessive time on the computer use for the determination of these roots for various angular velocities, Ω_o, and various diameter ratios, the tabulation of these roots was omitted.

The results of these investigations are in the process of being submitted for possible NASA-publication.

B. A computer program has been established for calculating the frequencies for a long rectangular tank with an elastic bottom. A numerical example has been treated for a rigid tank with aluminum bottom plate of 0.12 in thickness partially filled with a liquid with specific weight of 65 pounds per cubic foot. The lowest natural circular frequencies, ω, for the cases where the ratios of the liquid depth, H, to tank width L, are 1/8, 1/4, 3/8, 1/2, 5/8, and 3/4. The difference of the fundamental frequencies cannot be detected between the tank with rigid bottom and the tank with elastic bottom for the case where $\frac{H}{L} = \frac{3}{4}$. The results for the other five cases are shown in the following table:

Fundamental Frequencies ω

H/L	Elastic Bottom	Rigid Bottom
1/8	4.2779	4.3842
1/4	5.6970	5.7557
3/8	6.4275	6.4560
1/2	6.7898	6.8104
5/8	6.9629	6.9731

C. Axisymmetric oscillation of a rigid tank with an elastic hemispherical bottom has been formulated recently.

3. Plans for Next Reporting Period

A. Numerical values of frequencies for a rectangular tank with thinner (or more flexible) bottom plates will be evaluated. The effect of the flexibility

of the bottom plate related to the $\frac{H}{L}$ ratios may be concluded. It is intended that the results of these investigations will be submitted for possible NASA-publication.

B. The general solution derived for the axisymmetric oscillation of a rigid cylindrical tank with elastic hemi-spherical bottom will be examined further for correctness.

C. Numerical examples for other cases, where the general solutions have been derived previously, will be attempted.